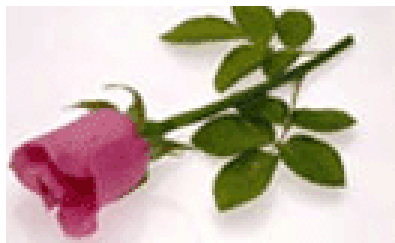
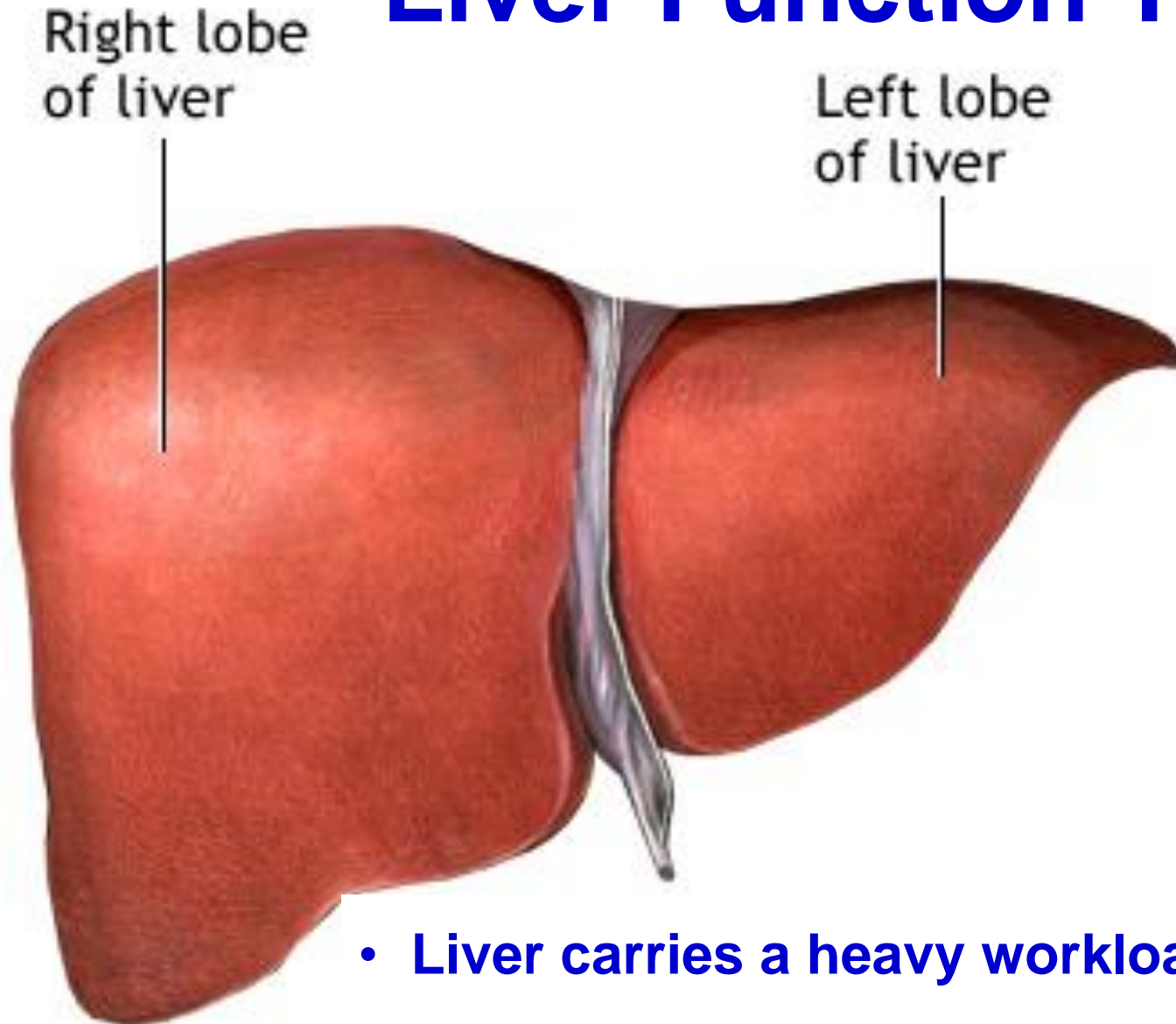


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اللهم اني أسألك علماً نافعاً

Liver Function Tests



- Liver carries a heavy workload for the body and almost never complains.

Functions of the Liver

- 1- Metabolic
- 2- Storage- Glycogen, vitamins (all Fat soluble and few water soluble), iron
- 3- Excretory/Secretory – bile excretion
- 4- Protective (eg. kuffer cells)
- 5- Coagulation – production of clotting factors
- 6- Detoxification of drugs via cytochromes.

LFTs are classified as:

- **Metabolic functions tests :**
Carbohydrates, Proteins, Fats
- **Synthetic capabilities :**
Proteins(albumin), coagulation factors
- **Detoxification :**
Ammonia, drugs
- **Tests of liver injury :**
Enzyme assays, autoimmune markers, markers of hepatitis virus infections

Metabolic functions

- Carbohydrate metabolism
 - Gluconeogenesis
 - Glycogenolysis and glycogenesis
- Hormone metabolism
- Lipid Metabolism
 - Synthesis of fatty acids, cholesterol, lipoproteins
 - Ketogenesis
- Drug Metabolism
- Protein Metabolism
 - Synthesis of plasma proteins
 - Urea synthesis

Uses of LFTs

- 1- Diagnosis of type of jaundice- etiology
- 2- Assess severity & follow trend of liver disease
- 3- Detect latent liver disease
- 4- Screening of infective hepatitis
- 5- Screen drug hepatotoxicity

Indication and limitation of LFT

- **Indication-**

- 1- Screen for liver diseases
- 2- Identifying the nature of liver diseases(hepatocellular, cholestatic, or infiltrative.)
- 3- Assess severity and prognosis of liver disease
- 4- Follow up the course of liver disease.

- **Limitations –**

- 1- Do not necessarily assess liver function.
- 2- Lack sensitivity
- 3- Lack specificity

What is Jaundice?

- Jaundice is yellowish discoloration of the skin, sclera and mucous membranes due to hyperbilirubinemia and deposition of bile pigments .
 - Equilibrium between bilirubin production and clearance is disturbed .
- In jaundice:**
- Serum bilirubin level greater than 2mg/dL
 - Jaundice is NOT a disease, but rather a sign that can occur in many different diseases.
 - **Strenuous exercise increases significantly bilirubin level**

Test that assess excretory function

- Jaundice –

Evident when

bilirubin >2 mg/dl.

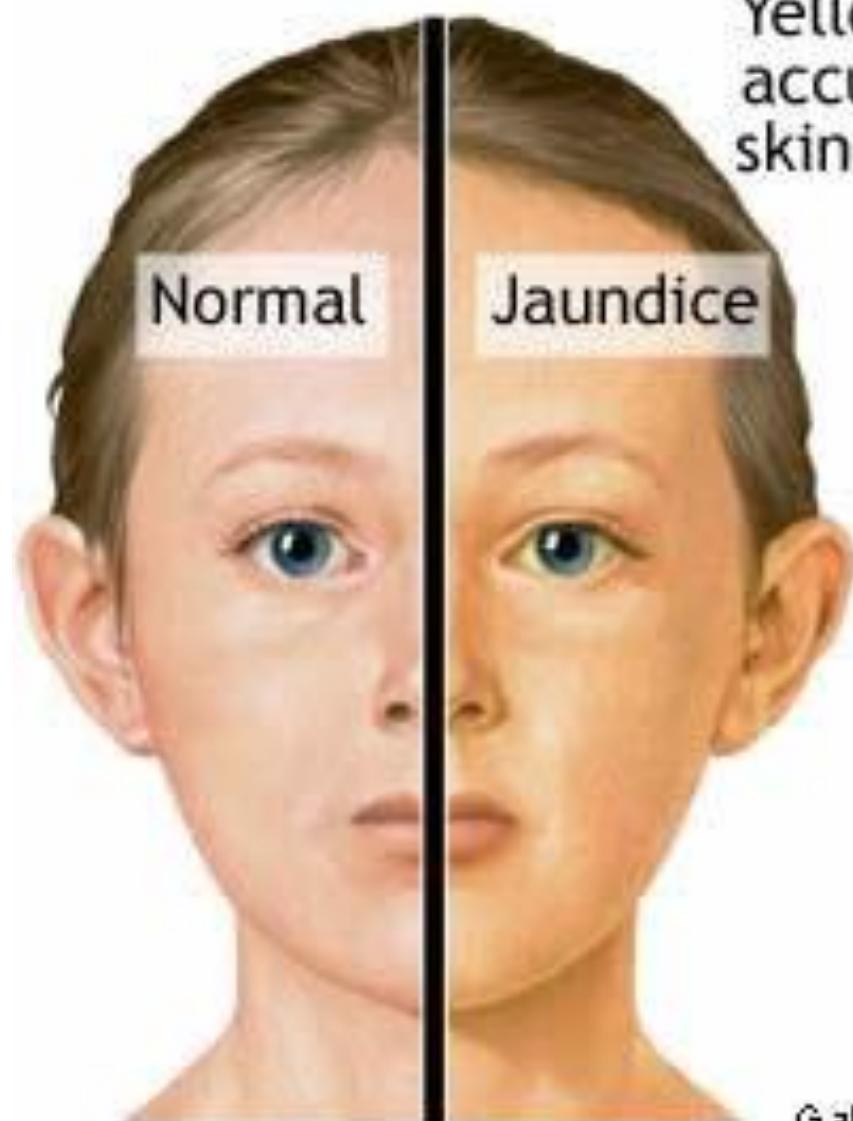
- Classification of jaundice-

1. According to type of bilirubin increased-

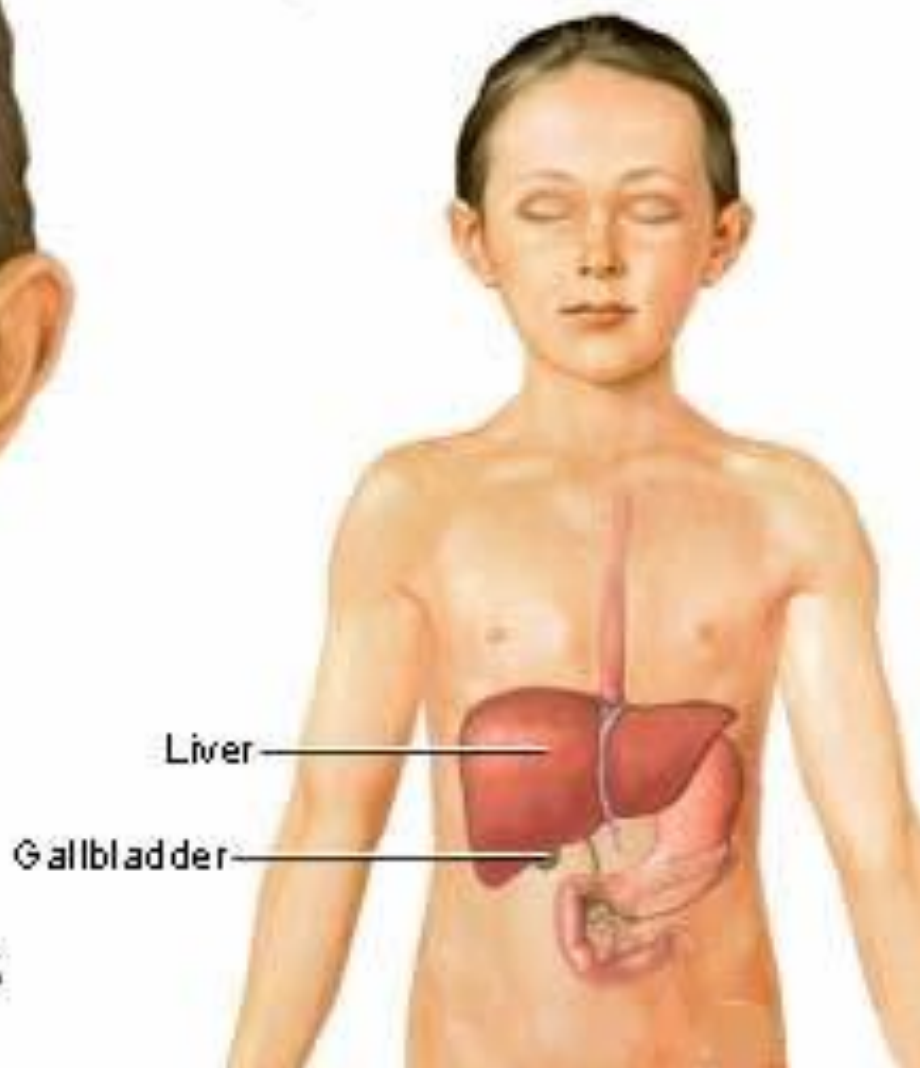
A – Unconjugated hyperbilirubinemia (unconj.
Bilirubin > 85% of total)

B – Conjugate hyperbilirubinemia (conj. Bilirubin >
20%)

Yellowing is associated with the accumulation of bilirubin in the skin, most often caused by liver and gallbladder disorders



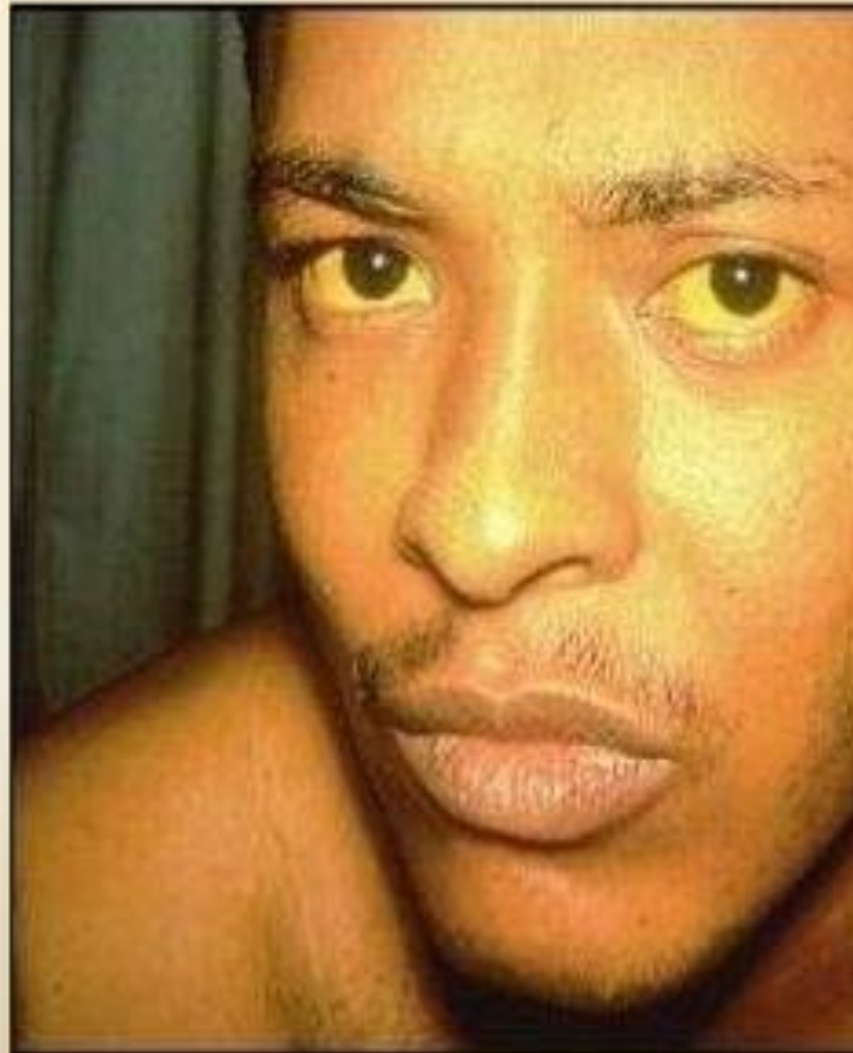
Jaundice is a symptom where the skin and eyes become yellow



❖ Signs and Symptoms of Jaundice

Common signs and symptoms seen in individuals with jaundice include:

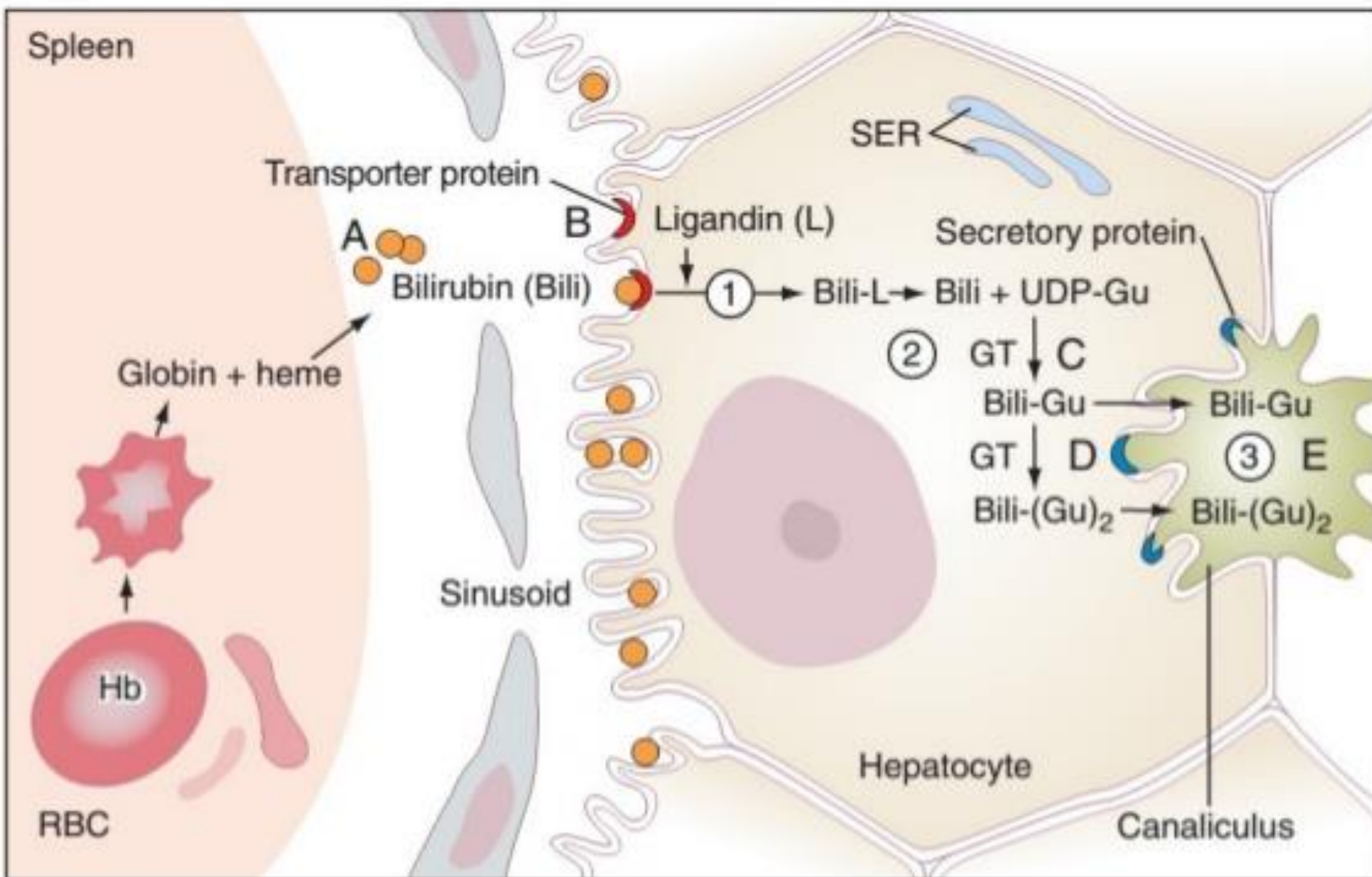
1. yellow discoloration of the skin
2. mucous membranes
3. the whites of the eyes
4. light-colored stools
5. dark-colored urine
6. itching of the skin.
7. nausea and vomiting
8. abdominal pain
9. fever
10. weakness
11. loss of appetite
12. headache
13. confusion
14. swelling of the legs and abdomen.

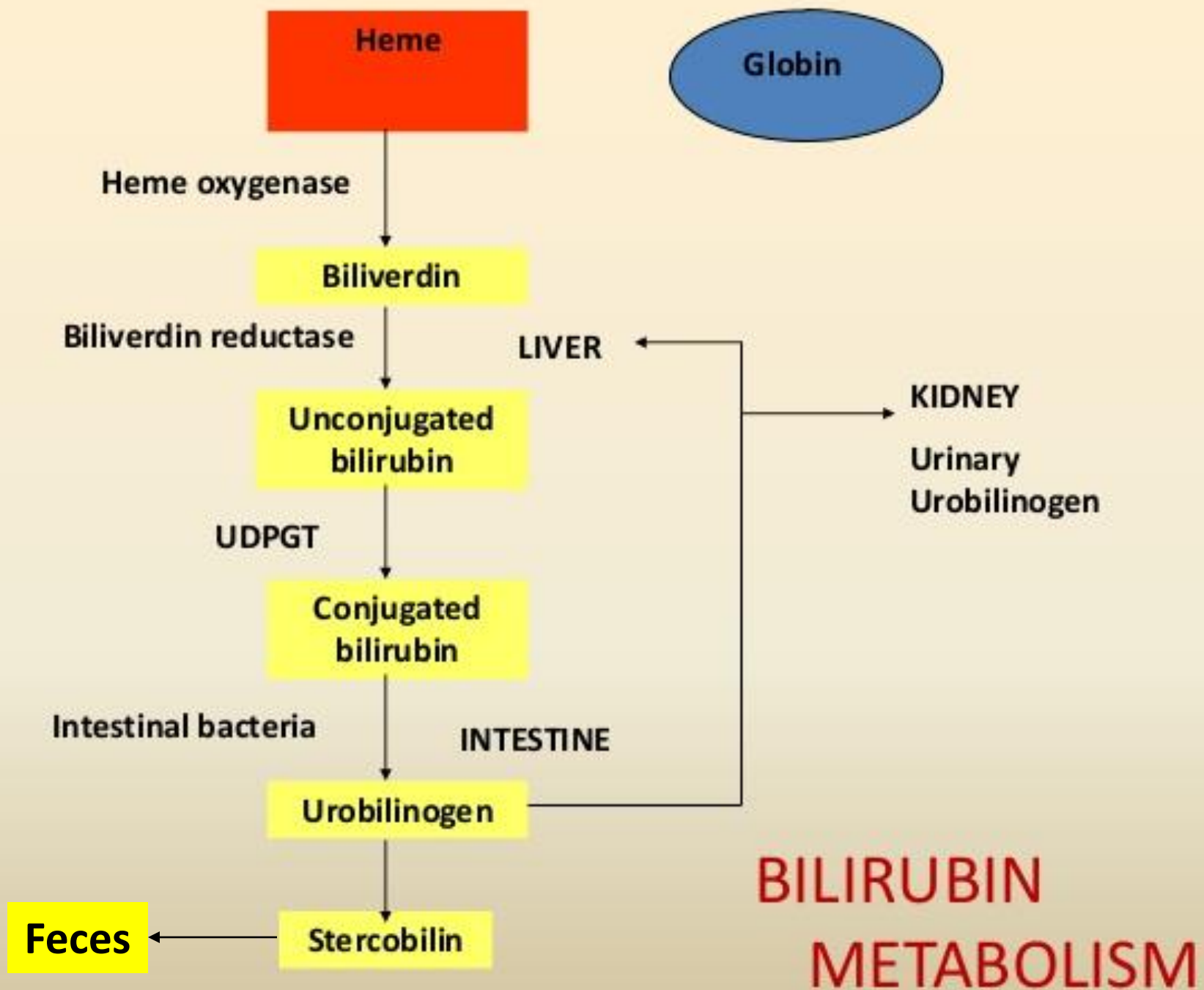


What is bilirubin?

- Bilirubin is a yellowish pigment found in bile, a fluid made by the liver.
- The breakdown product of Hgb from injured RBCs and other heme containing proteins. **myoglobin, cytochromes, catalase, peroxidase & nitric oxide synthase.**
- Produced by reticuloendothelial system
- Released to plasma bound to albumin
- Hepatocytes conjugate it and excrete through bile channels into small intestine.

Bilirubin Metabolism





Bilirubin - interpretation

- Normal bilirubin level- upto 1mg%
- Direct bilirubin upto 0.3mg%
- direct bilirubin(Conjugated)
 - <20% of total-hemolytic jaundice
 - =20-40%of total- hepatocellular jaundice
 - >50%of total- post hepatic jaundice

What causes ↑ bilirubin?

1. Overproduction by reticuloendothelial system
2. Failure of hepatocyte uptake
3. Failure to conjugate or excrete
4. Obstruction of biliary excretion into intestine

Normal Range of Bilirubin

It is normal to have some bilirubin in your blood. Normal levels are:

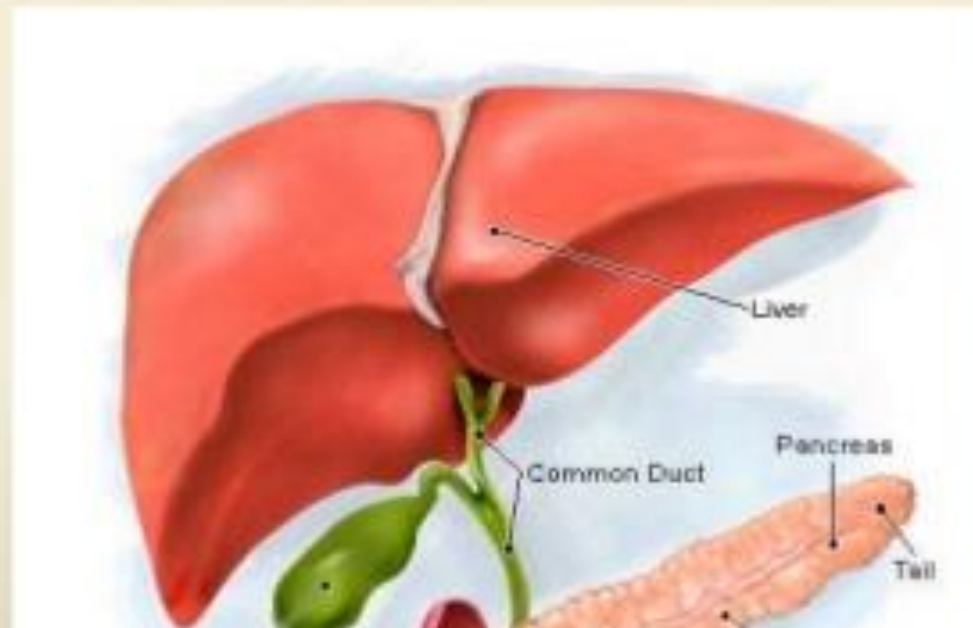
- Direct (also called conjugated) bilirubin: 0 to 0.3 mg/dL
- Total bilirubin: Up to 1.0 mg/dL

➤ Causes of Jaundice

Jaundice occurs when there is:

1. too much bilirubin being produced for the liver to remove from the blood (for example, patients with hemolytic anemia have an abnormally rapid rate of destruction of their red blood cells that releases large amounts of bilirubin into the blood)
2. a defect in the liver that prevents bilirubin from being removed from the blood, converted to bilirubin/glucuronic acid (conjugated) or secreted in bile; or

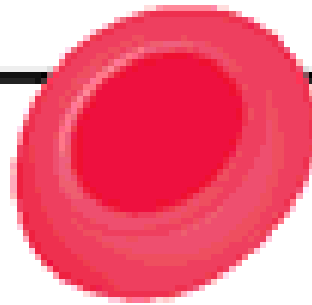
3- blockage of the bile ducts that decreases the flow of bile and bilirubin from the liver into the intestines. For example, the bile ducts can be blocked by cancer, gallstones, or inflammation of the bile ducts. The decreased conjugation, secretion, or flow of bile that can result in jaundice is referred to as cholestasis: however, cholestasis does not always result in jaundice.



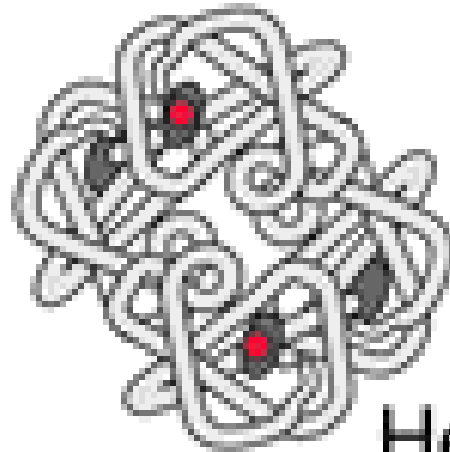
TYPE OF JAUNDICE

MAJOR CAUSE

A. Prehepatic

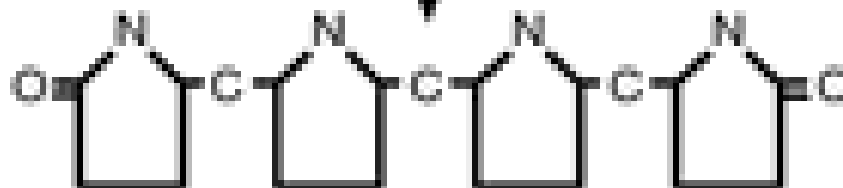


Red blood cell



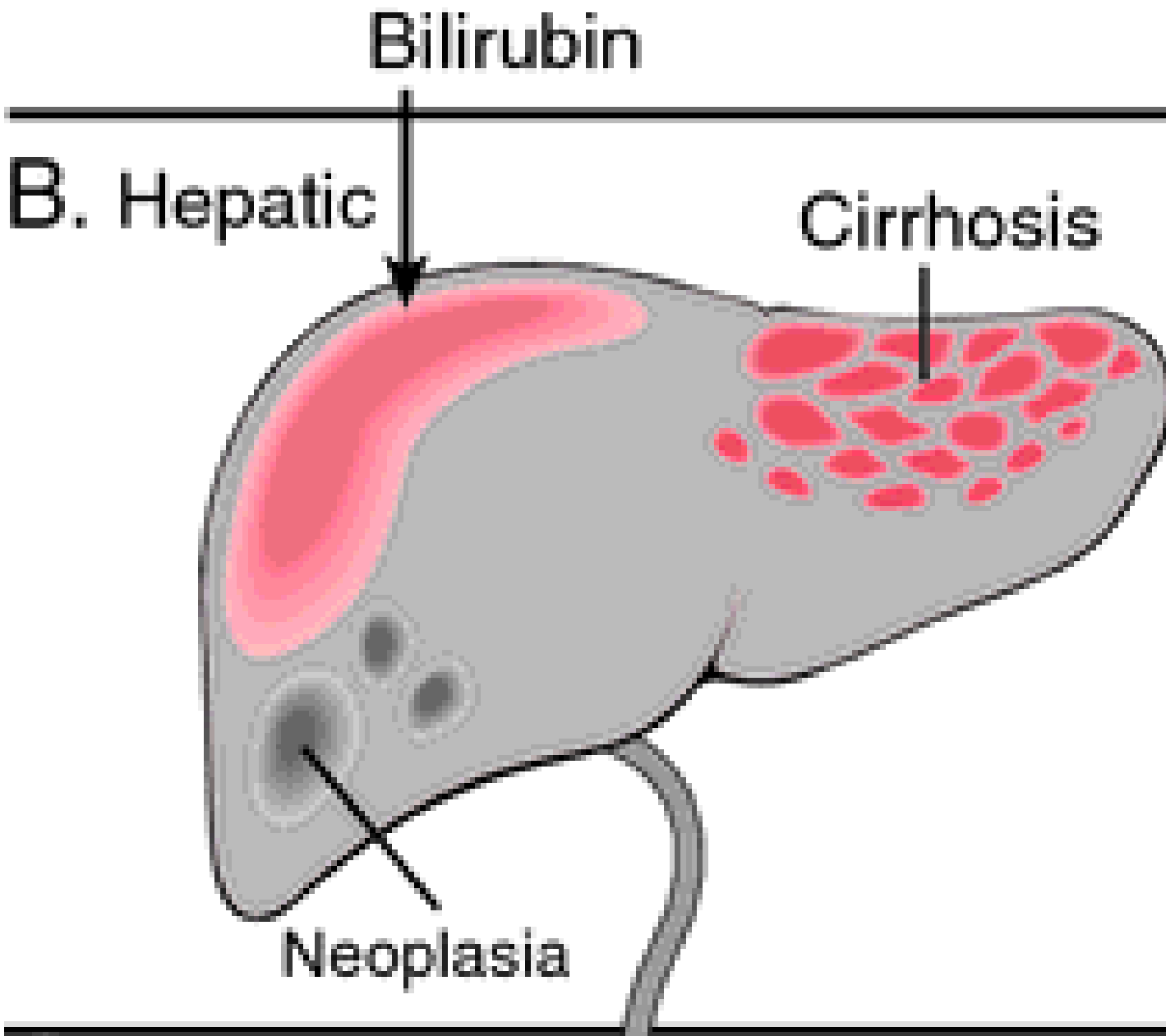
Hemolysis

Hemoglobin



Bilirubin

Causes



Viral
hepatitis
Drugs
Cirrhosis
Tumors

C. Posthepatic

Bile duct

Gallbladder

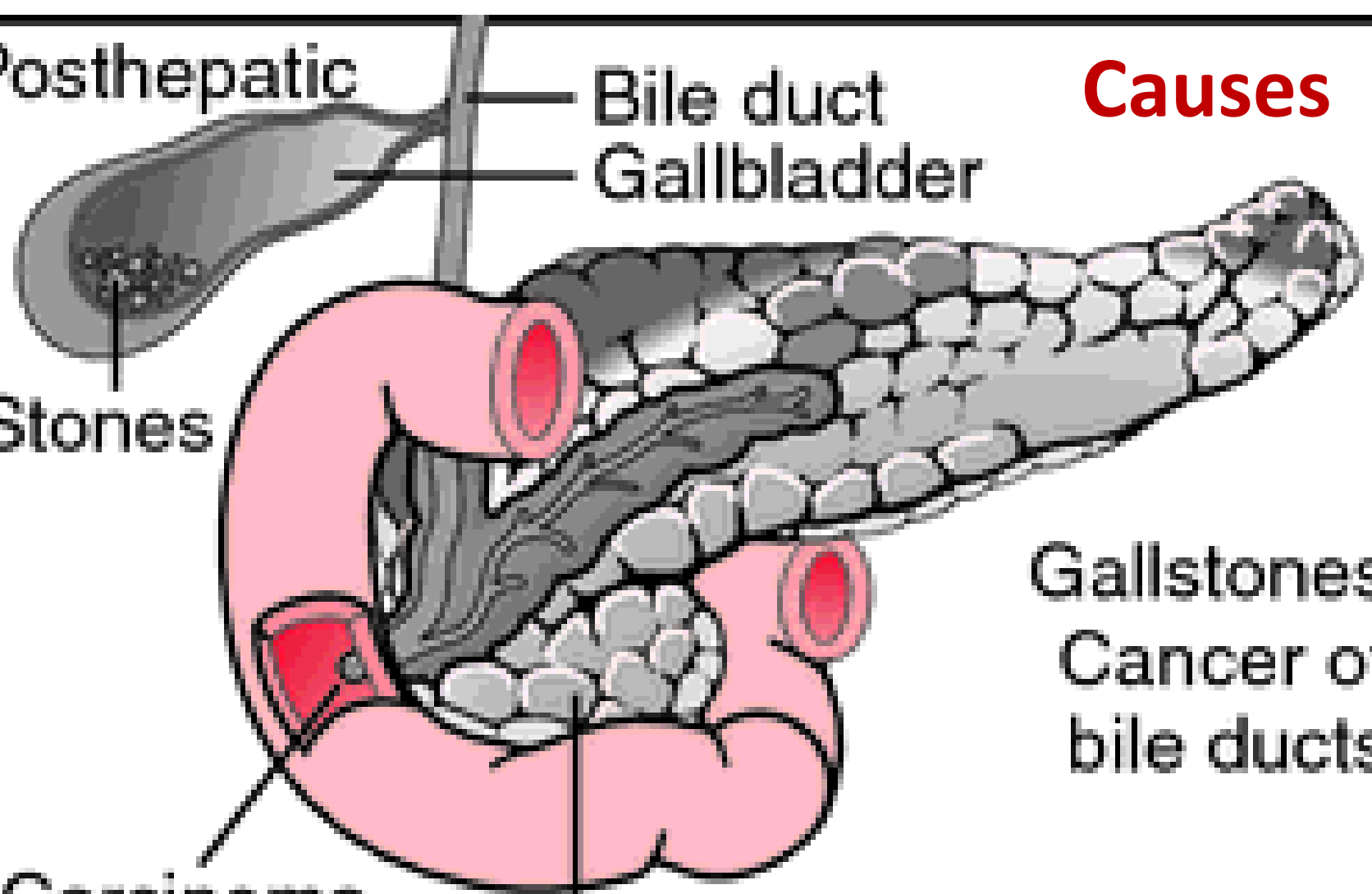
Causes

Stones

Gallstones
Cancer of
bile ducts

Carcinoma
of ampulla
of Vater

Carcinoma of head
of pancreas



Causes OF JAUNDICE

PRE HEPATIC	HEPATIC	POST HEPATIC
Hemolytic Anemia	Hepatitis, cirrhosis, Crigler- Najjar Syndrome, Dubin-Johnson Syndrome, Rotor's Syndrome	Gallstone, malignancy, inflammation

TYPES OF JAUNDICE

PRE HEPATIC	HEPATIC	POST HEPATIC
Excessive amount of bilirubin is presented to the liver due to excessive hemolysis	Impaired cellular uptake, defective conjugation or abnormal secretion of bilirubin by the liver cell	Impaired excretion due to mechanical obstruction to bile flow
Elevated (indirect) unconjugated bilirubin in serum	Both conjugated and unconjugated bilirubin may be elevated in serum	Elevated conjugated bilirubin in serum (direct)

TYPES OF JAUNDICE

TYPE	PRE HEPATIC	HEPATIC	POST HEPATIC
Urine color	normal	dark	dark
Stool color	normal	normal	acholic عديم الصفراء
Pruritus	no	No	yes

There are other types of Jaundice :

❖ Pathologic Jaundice

Pathologic jaundice can occur in children and adults and is diagnosed when jaundice presents a health risk. Several forms of hepatitis, cirrhosis of the liver and other liver diseases, bile duct blockage, along with infections and medications, can also cause pathological jaundice.

❖ Gilbert Syndrome Jaundice

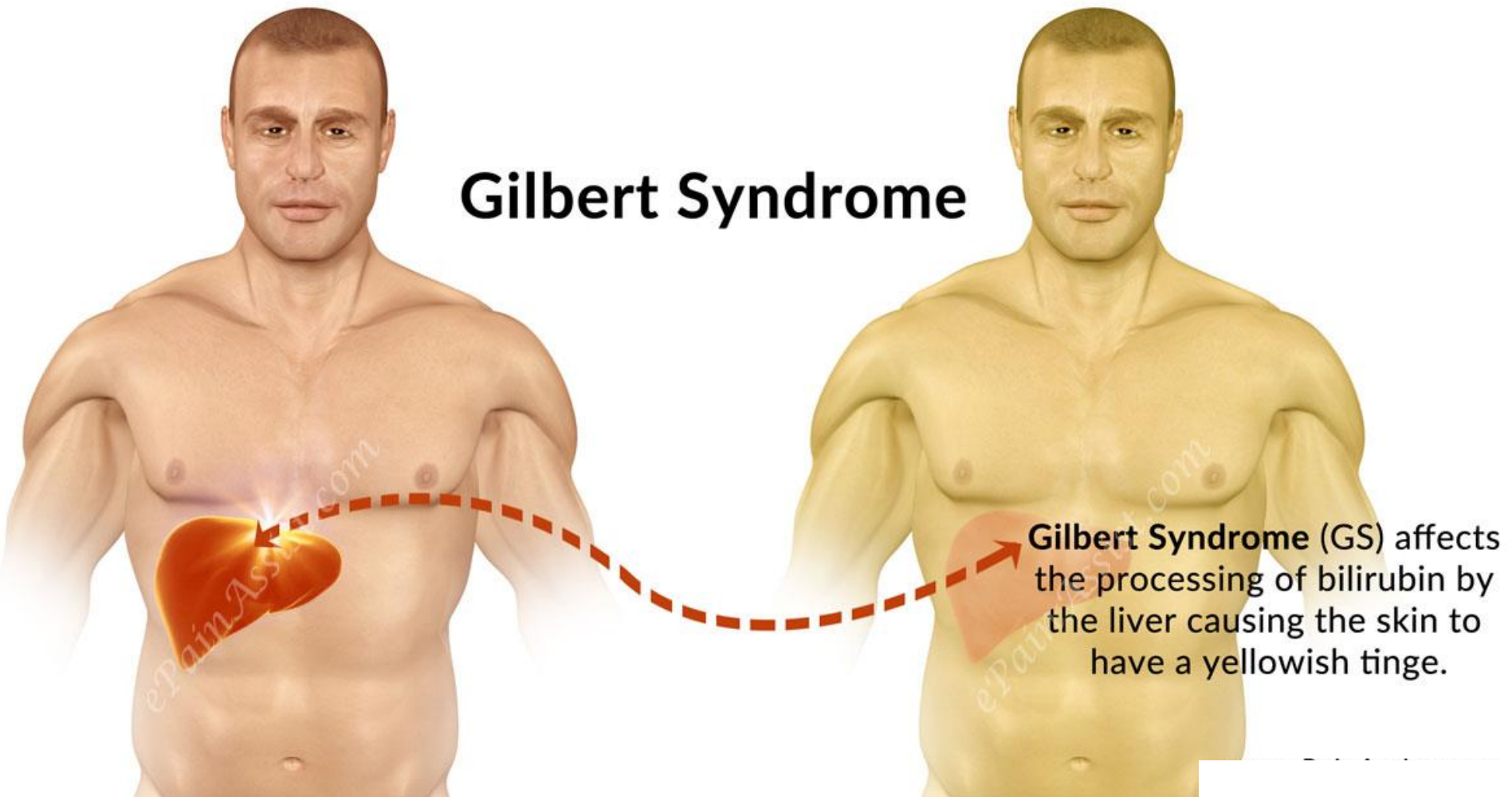
Gilbert's syndrome is a harmless hereditary condition that results in mild jaundice. During times of illness or stress, people with Gilbert's syndrome will experience low levels of some bilirubin-processing enzymes in their livers, according to [LabTestsOnline.com](https://www.labtests.com). Once diagnosed, Gilbert's syndrome does not require further medical treatment.

2. Hepatic Jaundice cont.

a) Gilbert Syndrome

- It is a benign hereditary disorder characterized by intermittent unconjugated hyperbilirubinemia in the absence of hemolysis and underlying liver disease due to a defective conjugation system.
- usually manifests during adolescence or early adulthood.
- The molecular basis of Gilbert syndrome is related to the glucuronyltransferase superfamily, which is responsible for encoding enzymes that catalyze the conjugation of bilirubin.

Gilbert Syndrome



Crigler–Najjar syndrome

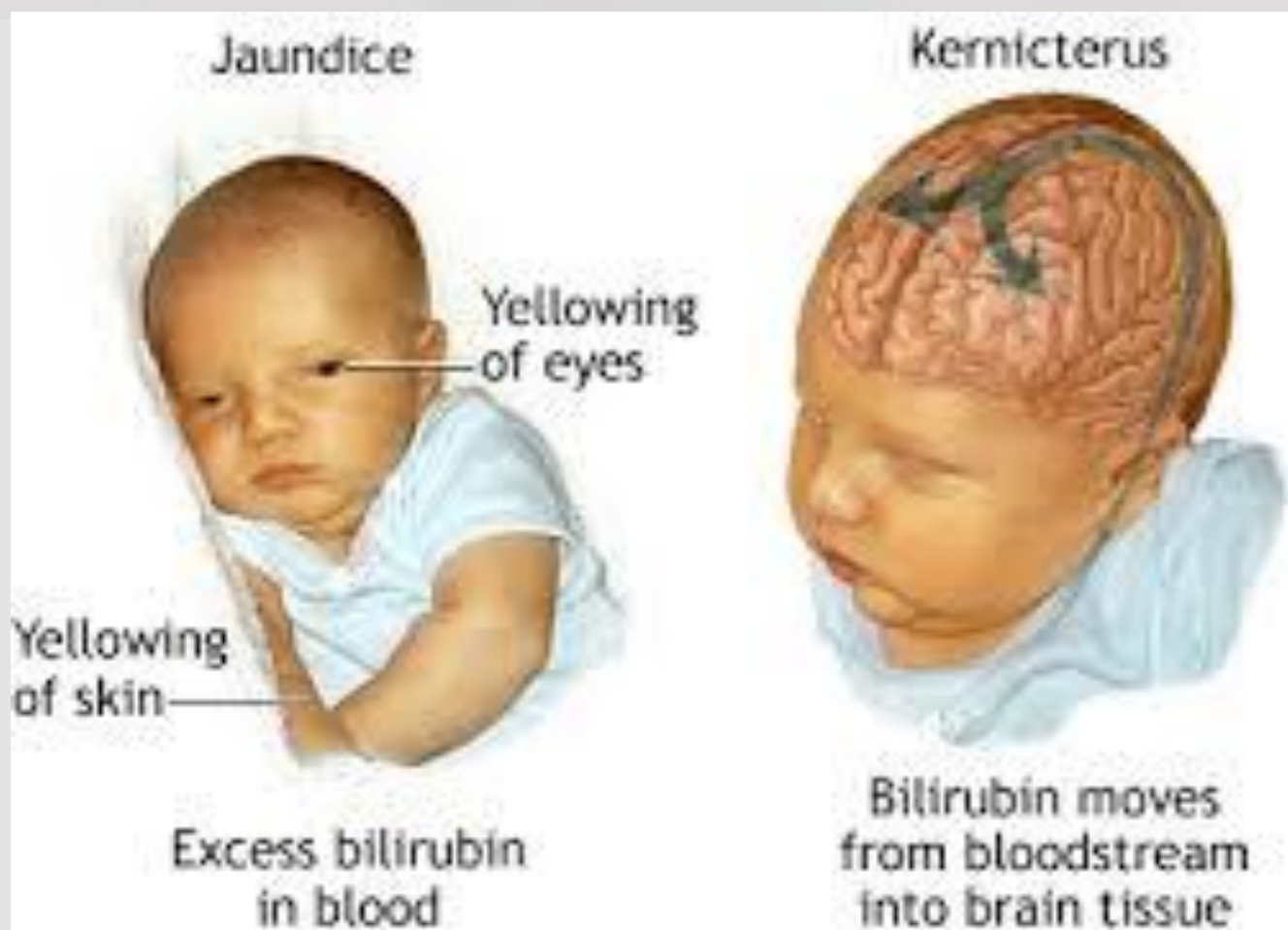
- It is due to multiple gene defects and causes very severe hyperbilirubinaemia potentially leading to kernicterus.
- There is little effective treatment other than prolonged phototherapy.
- Liver transplantation has been successful in some severe cases; in milder cases phenobarbitone may lower the bilirubin.

Crigler-Najjar syndrome:

- Patients with Crigler-Najjar syndrome have a deficiency or limitation of glucuronyl transferase enzyme.
- Patients with limitation of glucuronyl transferase enzyme can be treated by phototherapy and phenobarbital drug (which helps the body to produce more glucuronyl transferase).

b) Crigler-Najjar syndrome

- Is a syndrome of chronic nonhemolytic unconjugated hyperbilirubinemia.



Dubin-Johnson Syndrome

- An autosomal recessive form of **conjugated hyperbilirubinemia** characterized by defective bilirubin transport out of the liver and into the bile duct.
- Characterized by a striking **brown-to-black discoloration of the liver** caused by the deposition of granules of very dark pigment, the chemical nature of which is unclear.

Rotor syndrome

- **Rotor syndrome** is a rare, relatively benign autosomal recessive bilirubin disorder of unknown origin.
- It has many things in common with Dubin-Johnson syndrome except that in Rotor Syndrome, the liver cells are not pigmented. The main symptom is a non-itching jaundice.
- There is a rise in bilirubin in the patient's serum, mainly of the conjugated type.

Neonatal Jaundice:

- Most common and harmless.
- It presents second day of birth and disappears by 2 weeks.

Causes:

- In newborns, jaundice tends to develop because of two factors:
- The breakdown of [fetal hemoglobin](#) as it is replaced with [adult hemoglobin](#).
- The relatively immature metabolic pathways of the liver, which are unable to conjugate and so excrete bilirubin as quickly as an adult.

❖ Signs and Symptoms of Neonatal Jaundice

Newborns, as the bilirubin level rises, jaundice will typically progress from the head to the trunk, and then to the hands and feet. Additional signs and symptoms that may be seen in the newborn include:

1. poor feeding
2. lethargy
3. changes in muscle tone
4. high-pitched crying
5. seizures.

Healthy baby



Baby with severe jaundice





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